



Python in Education  
Seminar

# teaching\_python

# 10+ years of successes, trials and tribulations



Bruce Fuda  
@Bruce1979



# The guy at the front...



**Bruce Fuda**

Director of Technologies

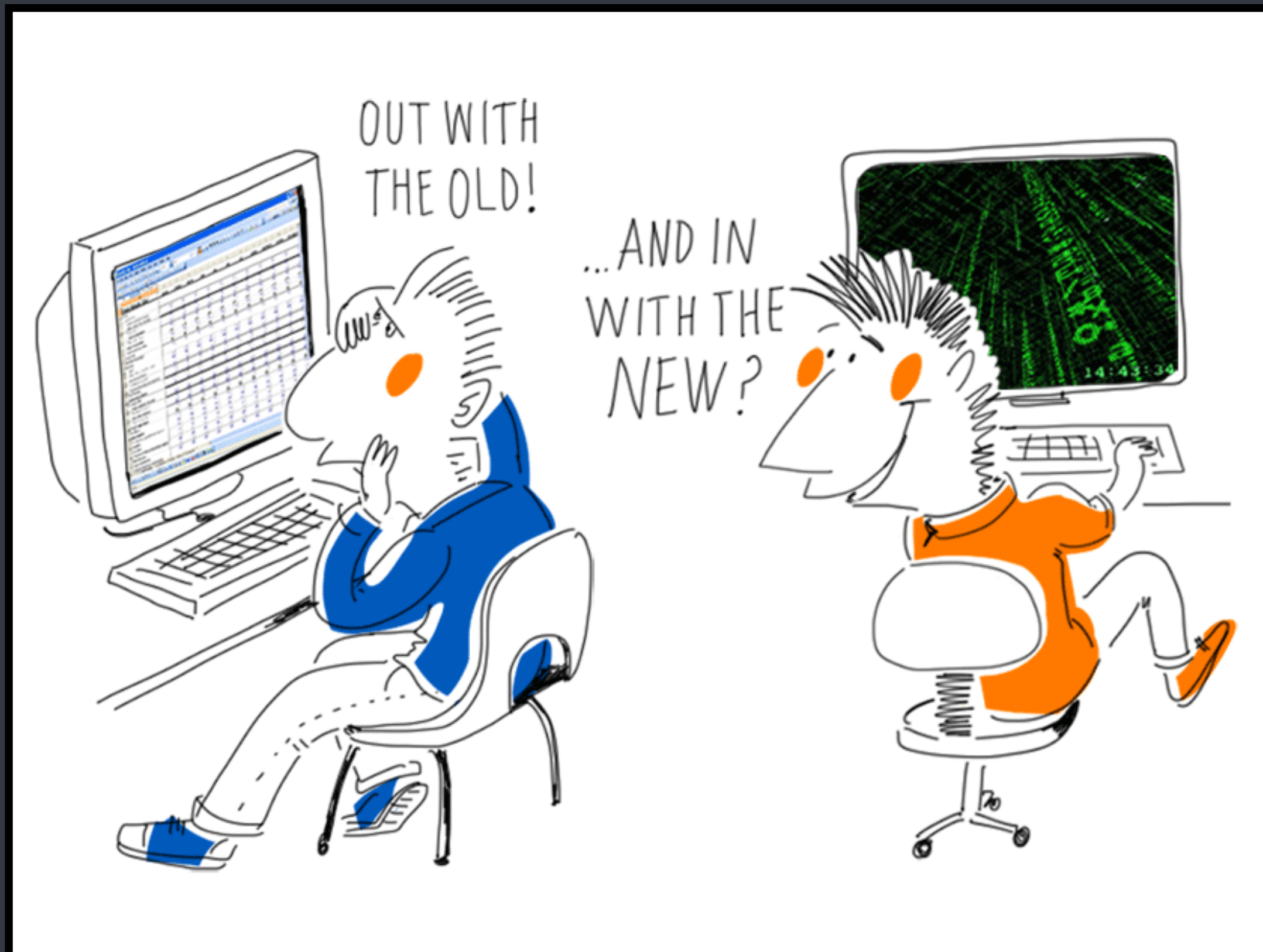
experience = [“teacher”: “12 years; government high schools and colleges, ACT”,  
“developer”: “web applications - school support; python/flask, HTML/CSS/JS”  
“curriculum”: “adviser and writer for Australian Curriculum: Technologies”]



# the\_educational\_landscape

# the need for a robust, engaging and rigorous Computer Science curriculum

# It's a bit of a mess...



<http://theday.co.uk/technology/boring-computer-curriculum-just-doesn-t-get-it>, 12 January 2012

- Hasn't kept up with changes in industry
- Dated curriculum
- Lack of teacher expertise
- Inconsistent between jurisdictions; schools
- Low demand from students and parents
- Has an image problem
- But... the Australian Curriculum has now been endorsed!



# Digital Technologies



- **Digital Systems**  
Hardware, software, networks and the Internet

- **Data**  
Properties, sources, collection, symbolism, patterns, contexts

- **Interactions and Impact**  
People, systems, processes, sustainability, empowerment

- **Algorithms**  
Defining problems and designing solutions

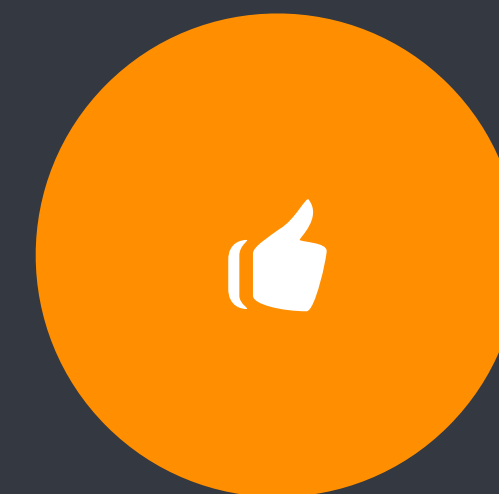
- **Abstraction**  
Underpins all other concepts



The environment is changing...

# Implementation

Since endorsement, authorities nationwide have committed to implementation of the Australian Curriculum in full from Foundation to Year 10



2016



2017



2018



# my\_experience

# 2005-2016: deciding on a language and approach to teaching programming

Teaching  
~~[Programming]~~  
isn't easy...

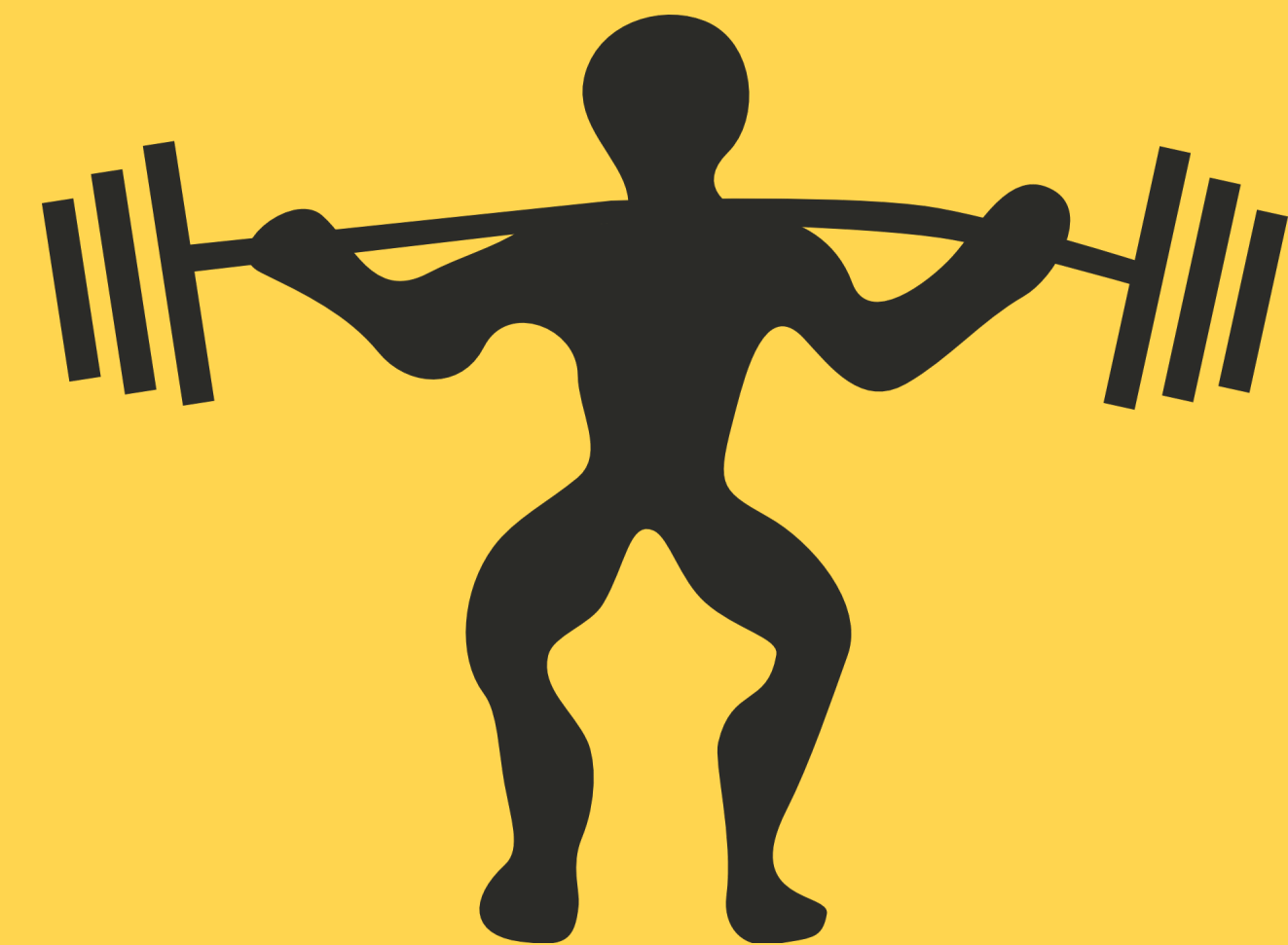


# Unfamiliar

Programming is new to almost all students when it is introduced at school

# Hard

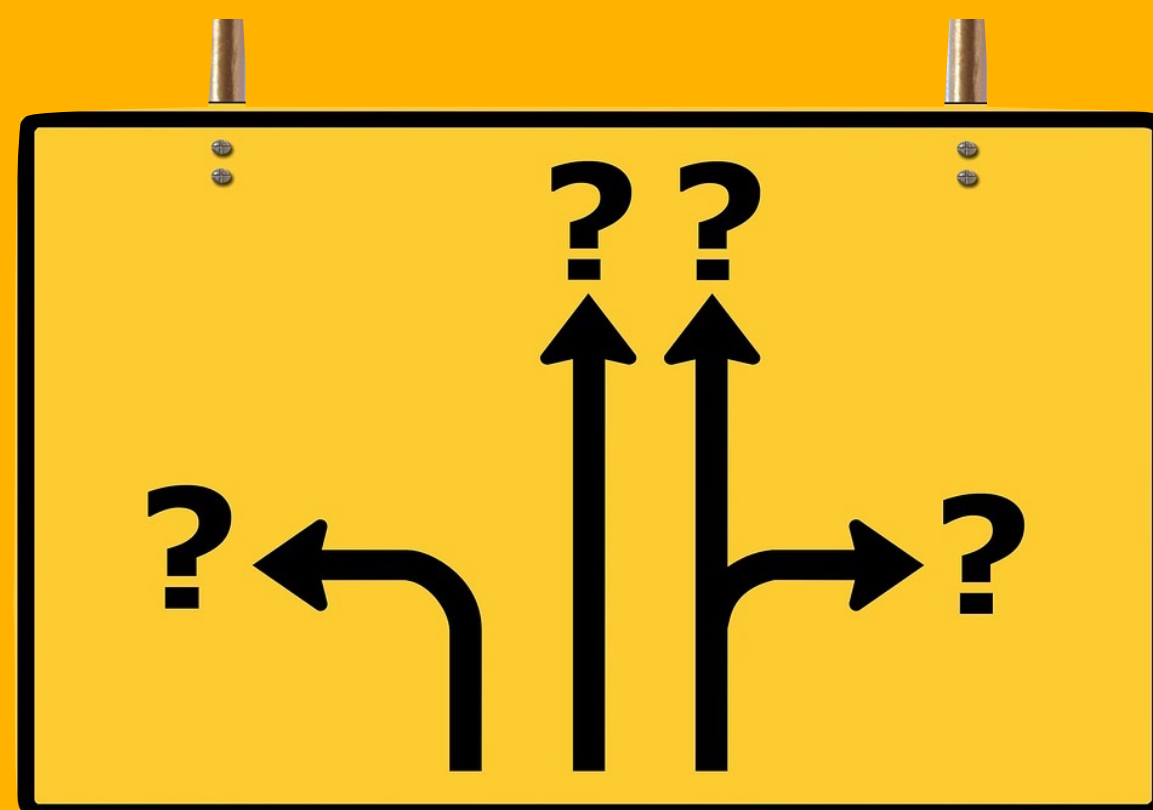
Compared to other subjects due to lack of familiarity;  
opt out in high stakes situations e.g. Year 11/12





# Experience

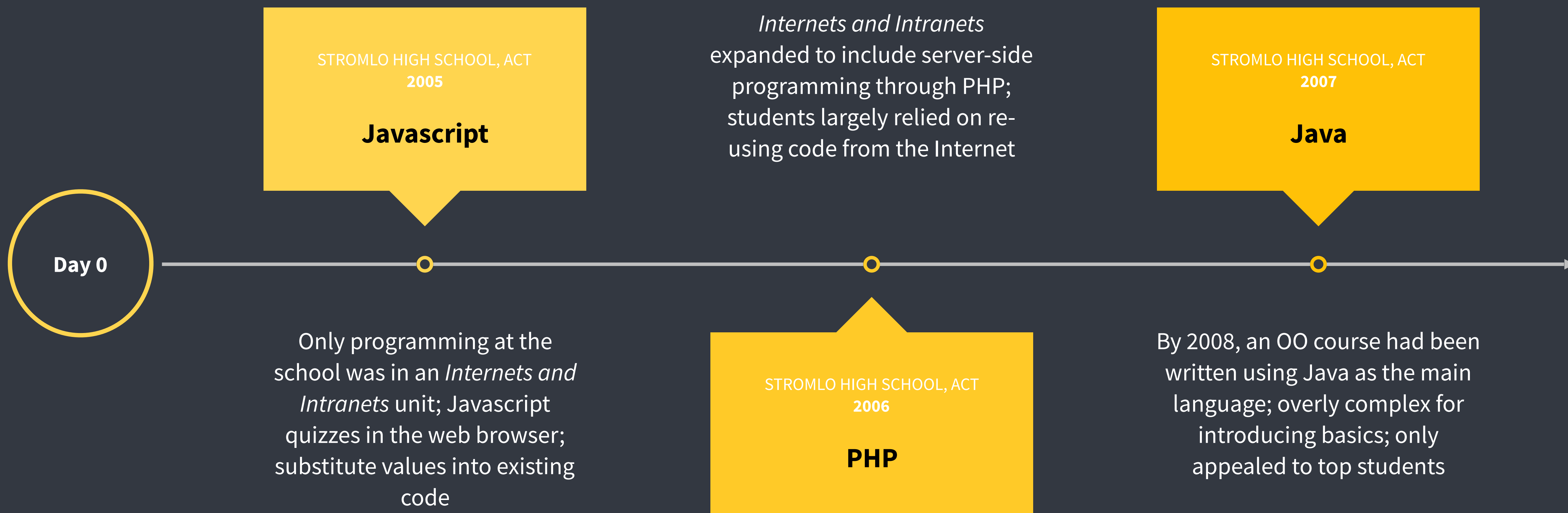
IT Classes are boring - applications, process;  
Would rather do something stimulating



# Expectation

Most parents and students don't know what to expect;  
Using an iPad != capable developer

# Starting Out



# Python Adoption

Learn to program with Python through browser; high engagement; well scaffolded

InTEACT, ACT  
2012

## Python Growth

Gungahlin College uses Python as primary language (some Arduino); Highest IT enrolments in the ACT

Now

STROMLO HIGH SCHOOL, ACT  
2009

## The NCSS Challenge

Successes from NCSS Challenge shared with teachers across ACT; Increased participation; Higher visibility of Python in high schools

GUNGAHLIN COLLEGE, ACT  
2016

## Python Dominance

It's pretty great...

# Python strengths



## Installation and use

No special IDE necessary  
Cross-platform  
Very little technical support required

**01**  
**Simplicity**



## Beyond basics

With support of frameworks  
(such as Flask and plot.ly) it can  
be used in wider applications

**04**  
**Flexible**



## Clean, readable syntax

Statements, syntax and  
grammar are easy for  
beginning programmers

**02**  
**Friendly**



## Learn what you want

Lots of online resources to  
teach Python, many specifically  
targeted to education

**05**  
**Resources**



## Scripting, Object-Oriented

Built-in and readily available  
modules make doing  
interesting things a breeze

**03**  
**Powerful**



## You're not alone

The Python community is  
active and supports beginners  
(teachers and students)

**06**  
**Support**

But there are a few minor frustrations

# Obstacles to learning



- ✗ Graphics and games
- ✗ Peripherals
- ✗ Bundling applications

... but experience solves a lot of this!



[2]

# lessons\_learned

# avoiding the traps; exploiting the strengths

# Make it as painless as possible:

## Fundamentals

- assignment <
- comparison <
- control structures <
- functions definition <
- class definition <

1





[interactivepython.org](http://interactivepython.org)

*How to Think Like a Computer Scientist*



# Think; code

think about the problem <

design the solution <

identify the steps <

then write your code <

2







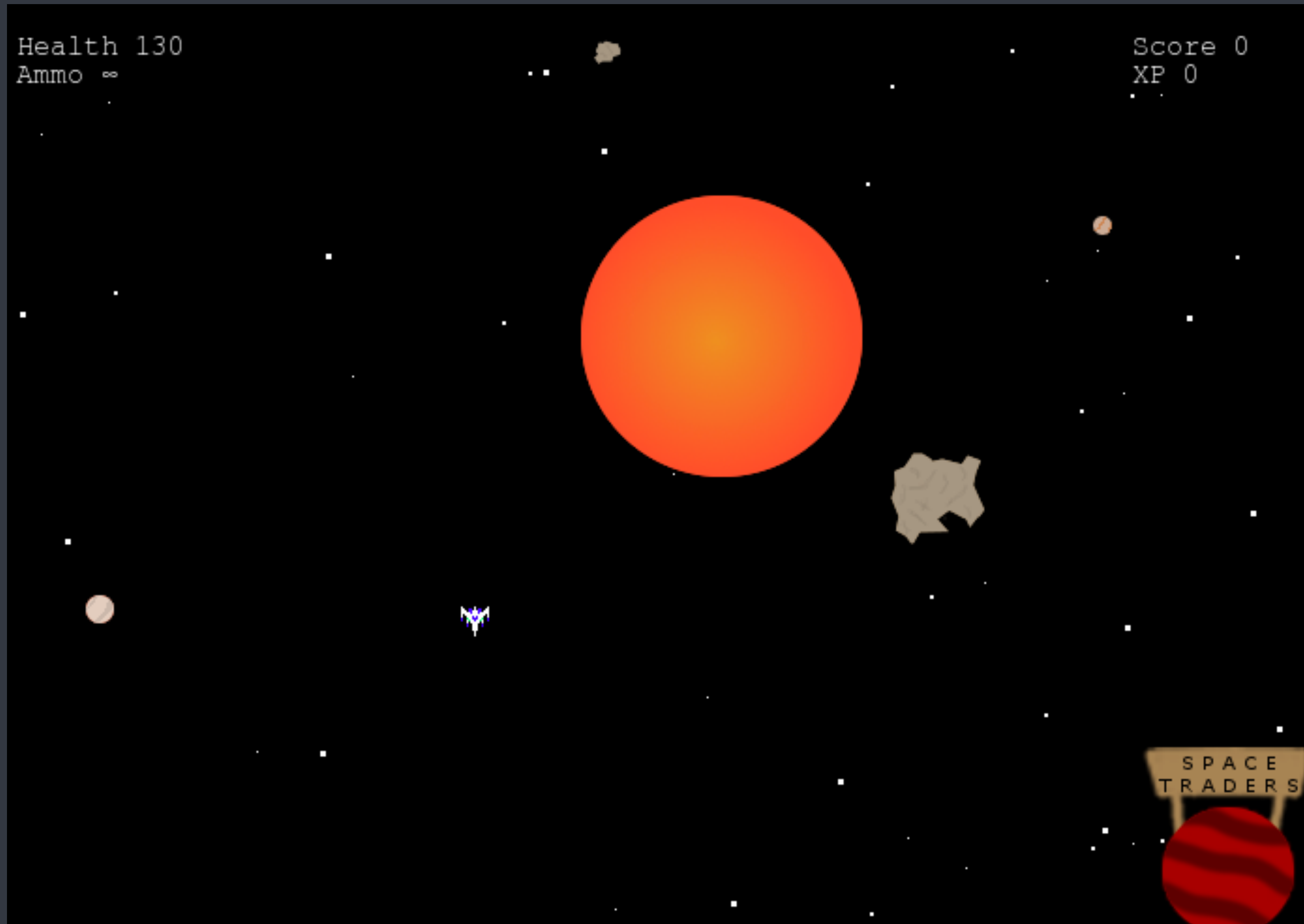


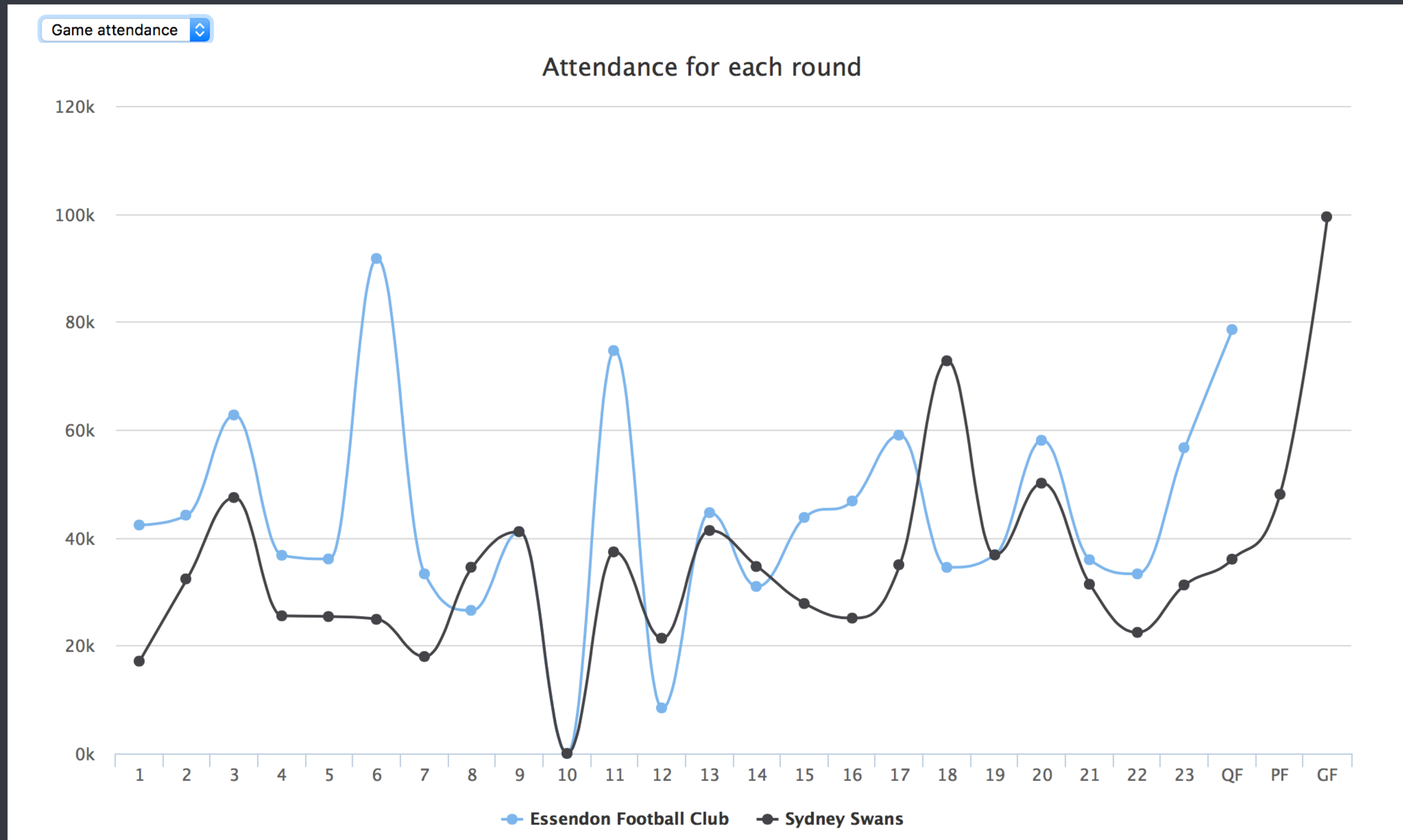
# Relevance

- meaningful tasks <
- appropriate complexity <
- solve real problems <

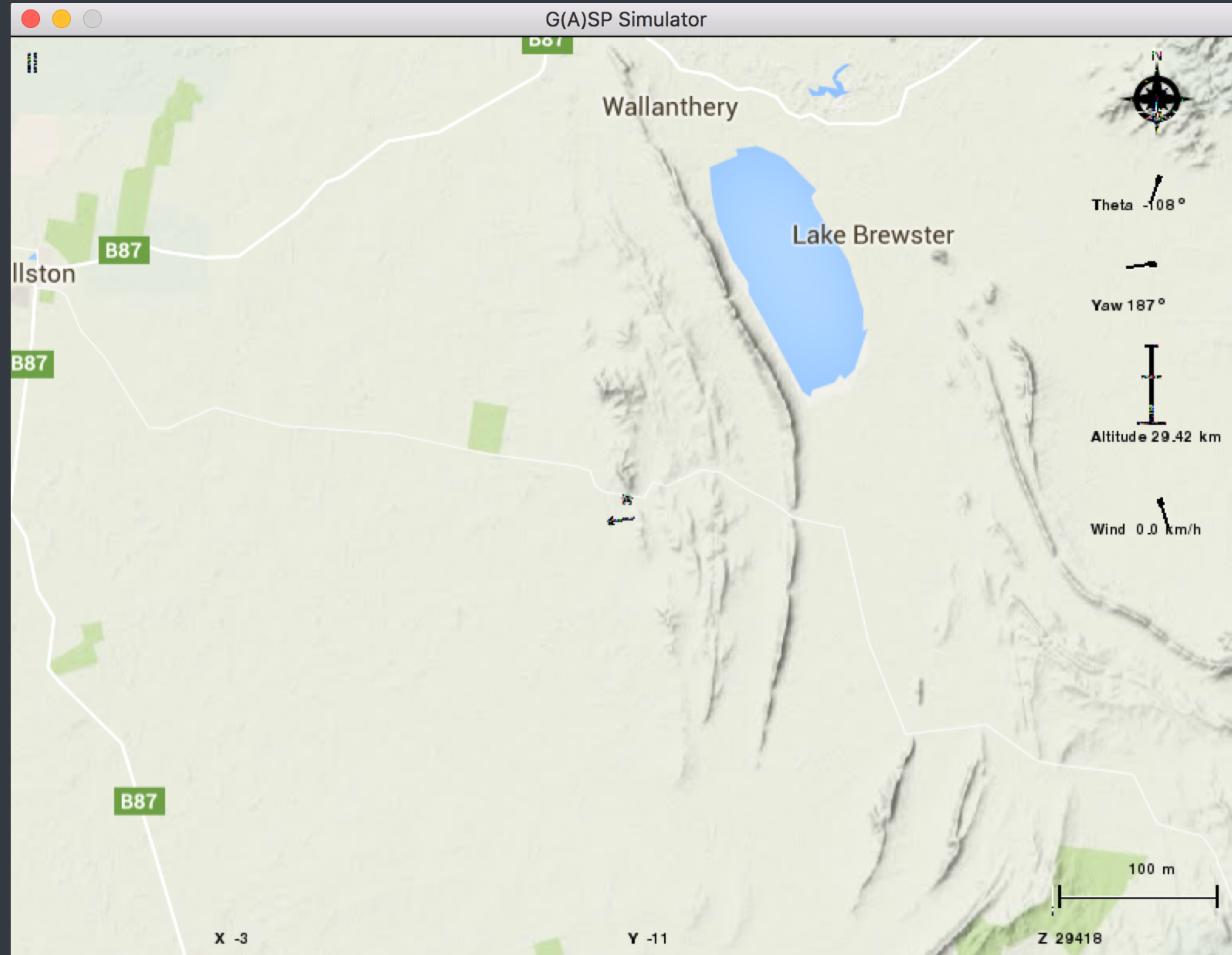
3













```
Welcome to Prophecy by GXT  
Copyright 2015
```

```
For Predictive Text, enter PT.  
For Parody Generator, enter PG  
To Edit Dictionary, enter ED.  
For more options, enter M.  
To reset dictionary, enter RESET  
To end program, enter end.  
Enter Choice: PG
```

```
Starting word: Harry  
Length of text: 300
```

```
Harry and escape and make up into an excessively interested in the gps and the submissive with the crowd into my mouth presses tobias crouches in here he can look at each other weekend? It is spacious room. It was cool smooth back with hovercraft at the corner the school where they were safe. It is making amends and smile that's because it was ever agree to the deadbolt. It happened before I might have put poison in. The lunchtime wouldn't settle into that day to get for me and I burst through me. A boy's a noise they'd tear with you for being slow motion the time we knock on to do you tonight? The image of all into the mood shifted suddenly as he deliberately unhurried no better that only they need a full of me tonight I knew charlie I close to seeing him this evening. A document. It seemed almost breaks down to do this tracker jacker. A miserable said she found our way and i'm not comprehending. A whisper pressing hard limits no one for a few more distinct dent in mind it's just to the last night. It is. It isn't your own and I quite a wizard coins from the house i'm all over the parachutes? The big day. It through; he lifted a riskfree environment in the probable than a large lobby waiting for casual erect the point plane and then whether they march day might be brave and flew up and take my father cronin waving and derricks in that desire to do as well. It down I won't. A little finger pressing myself that someday you really think of which might make with her? A good tough but I wish we were sitting. It was relatively tasteless but aware you
```

```
Parody generating finished, returning to menu.
```

```
Please enter another text: https://en.wikipedia.org/wiki/Python\_\(programming\_language\)
```

```
##### Summerized Text #####
```

```
CPython, the reference implementation of Python, is free and open-source software and has a community-based development model, as do nearly all of its variant implementations.
```

```
[42] Python uses dynamic typing and a mix of reference counting and a cycle-detecting garbage collector for memory management.
```

```
Methods on objects are functions attached to the object's class; the syntax instance.method(argument) is, for normal methods and functions, syntactic sugar for Class.method(instance, argument).
```

```
[72] Python allows boolean expressions with multiple equality relations in a manner that is consistent with general use in mathematics.
```

```
Python has a large standard library, commonly cited as one of Python's greatest strengths,[77] providing tools suited to many tasks.
```

```
The Nokia N900 also supports Python with GTK widget libraries, with the feature that programs can be both written and run on the target device.
```

```
[98] For example, the metasyntactic variables often used in Python literature are spam and eggs, instead of the traditional foo and bar.
```

```
##### End of Text #####
```



### Handwriting Recognition



```
'  
Forwarding Data  
a 0.365117099971  
p 0.0250376392161  
e 0.0167312315217  
,  
o 0.869011486254  
c 0.171375673354  
e 0.10918920427  
,  
e 0.681488001622  
o 0.178455302561  
t 0.0605079771834  
,  
b 0.174302002241  
d 0.130947121876  
t 0.0301863014898  
,  
a 0.0878207274696  
f 0.0679334199289  
w 0.0524827456653
```

# Collaborate

- make it social <
- differentiate on interest <
- draw on experiences <

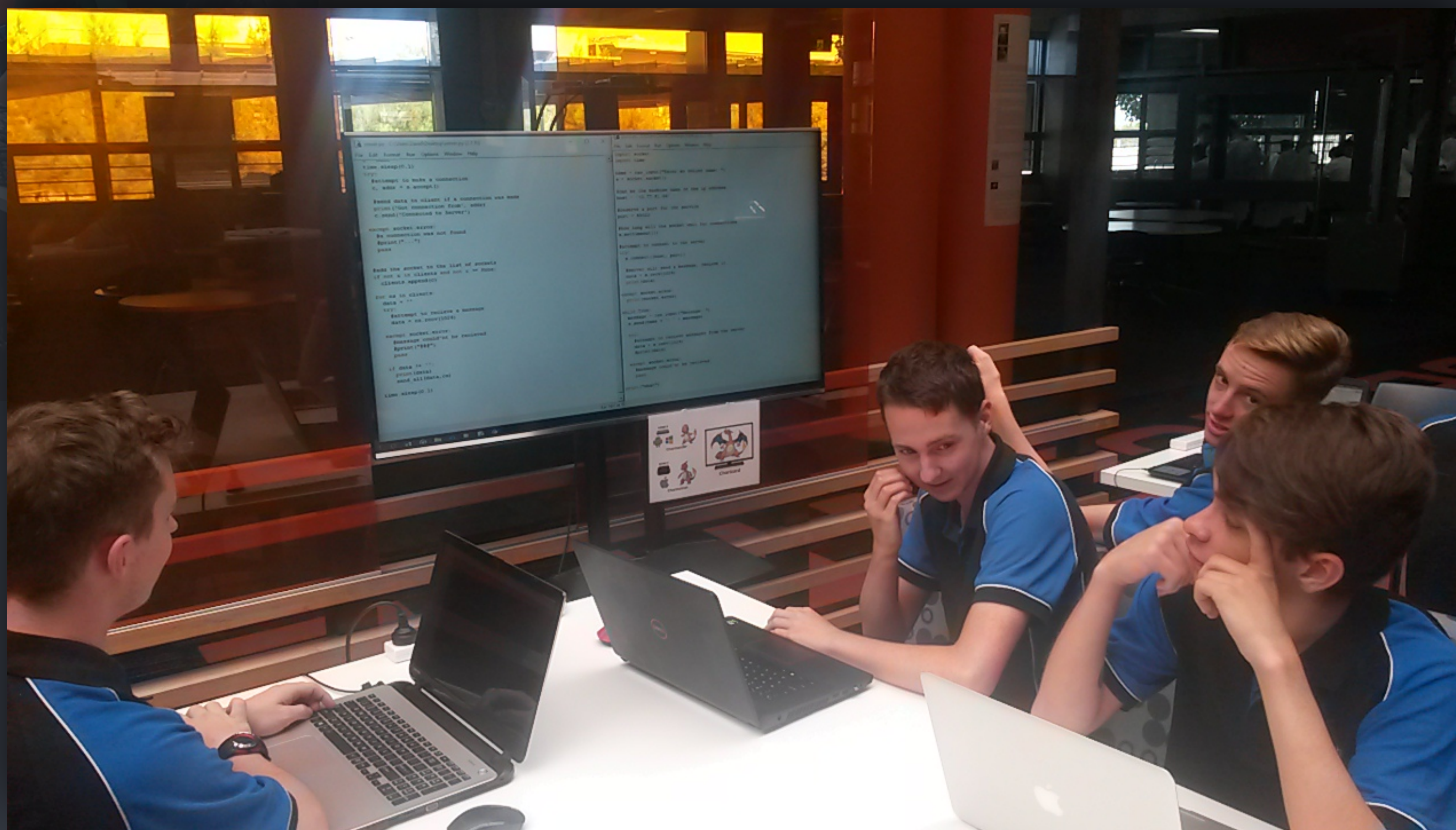
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# Open-ended

- start with something concrete <
- provide a progression <
- leave the destination undefined <

5



Ensure that there's something for everyone

# IT Task Structure

## Document

Document existing code  
Understand the role of each part

## Improve

Fix any broken features  
Add new (similar) ones

## Expand

Increase the scope  
Add new, unique features

## Redefine

Alter the underlying structure  
Show us what you can do!

We can all do this  
with teacher support

We're all  
challenged by this

[3]

# reflection

# the key to iterative improvement

# Why did you like learning Python?

*“...since it was pretty intuitive and close to natural language, it was easy to follow, and I tend to like anything that I can understand...”*

*“It not only taught me how to write code but also... how to think logically about the problems I was trying to solve... making it much easier for me in the future to learn other programming languages.”*



**Kat Gill**  
Student  
Gungahlin College  
New programmer



**Damanvir Singh**  
Student  
Gungahlin College  
5 years experience



# Success checklist



## **Teach the fundamentals**

Make sure students are equipped with the tools they need to solve problems

## **Emphasise thinking**

Writing the code is the easy part if your solution is well designed

## **Keep things interesting**

Make tasks genuine; provide context and a reason for writing a program

## **Everyone is on the same team**

Rivalry is a part of school - make it friendly and encouraging, not antagonistic

## **Don't restrict creativity**

Programming is as much an art as it is a tool

Thanks for your attention

# Questions?

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